CLAIMS

What Is Claimed Is:

1. A variable reflectance vehicle mirror which can be controlled to adjust reflectivity, comprising:

a super twisted nematic (STN) liquid crystal cell having a front side and a rear side;

a first polarization filter positioned on the front side of said STN liquid crystal cell;

a second polarization filter positioned on the rear side of said STN liquid crystal cell;

a reflective layer positioned adjacent to said second polarization filter; and

a control circuit connected to said STN liquid crystal cell for controlling the birefringence of the STN liquid crystal cell to adjust the degree of reflection of the mirror.

2. The variable reflectance vehicle mirror of claim 1, wherein said STN liquid crystal cell includes a layer of super twisted nematic (STN) liquid crystal material positioned between a pair of transparent electrodes.

3. The variable reflectance vehicle mirror of claim 2, wherein said STN liquid crystal material possesses a twist angle between approximately 180° and approximately 270° between the pair of electrodes.

4. The variable reflectance vehicle mirror of claim 3, wherein said STN liquid crystal material possesses a twist angle of approximately 210°.

5. The variable reflectance vehicle mirror of claim 2, wherein said STN liquid crystal material further includes a cholesteric material.

6. The variable reflectance vehicle mirror of claim 3, wherein the surfaces of the pair of electrodes facing one another each include an alignment layer positioned thereon for orienting the STN liquid crystal material to its desired twist angle.

7. The variable reflectance vehicle mirror of claim 6, wherein the alignment layers comprise a polymer material which is surface treated to provide the desired orientation of the STN liquid crystal material.

8. The variable reflectance vehicle mirror of claim 1, wherein said STN liquid crystal cell further comprises front and rear transparent plates respectively positioned adjacent to outer surfaces of said electrodes.

9. The variable reflectance vehicle mirror of claim 8, wherein said front and rear transparent plates are adhered together around their periphery to seal said STN liquid crystal cell together.

10. The variable reflectance vehicle mirror of claim 9, further comprising spacers being positioned in said STN liquid crystal material between the front and rear transparent plates in order to provide a constant thickness of the space between the front and rear transparent plates.

11. The variable reflectance vehicle mirror of claim 1, wherein the first and second polarization filters are crossed polarizers.

12. The variable reflectance vehicle mirror of claim 3, wherein the said control circuit is connected to said pair of transparent electrodes to apply a bias voltage across said electrodes.

13. The variable reflectance vehicle mirror of claim 12, wherein the bias voltage applied across said electrodes by said control circuit may be varied to vary the twist angle of the STN liquid crystal material between said electrodes in order to alter the reflectivity of the mirror to a desired level.

14. The variable reflectance vehicle mirror of claim 13, wherein said mirror is controllable over a continuous range of reflectance by varying the bias voltage applied across said electrodes.

15. The variable reflectance vehicle mirror of claim 1, wherein said control circuit includes a voltage regulator capable of receiving a source of power from a vehicle from between approximately 6 - 40 volts d.c. and generating a bias voltage to be applied to said STN liquid cell between approximately 2.7 to 5.5. volts d.c.

16. The variable reflectance vehicle mirror of claim 15, wherein said voltage regulator enables the mirror to be retrofit into all existing vehicles by utilizes an existing power harness in the vehicle which provides approximately 6 - 40 volts d.c.

17. The variable reflectance vehicle mirror of claim 1, wherein said control circuit is formed as a stacked IC.

18. The variable reflectance vehicle mirror of claim 1, wherein said control circuit includes an oscillator formed within the stacked IC for variably adjusting a driving frequency applied to the STN liquid crystal cell.

19. The variable reflectance vehicle mirror of claim 1, further comprising a first photo sensor for detecting an intensity of light impinging upon said first photo sensor, said control circuit being connected to said photo sensors for applying a bias voltage to said STN liquid crystal cell in accordance with the intensity of the light detected by said first photo sensor.

20. The variable reflectance vehicle mirror of claim 19, wherein the bias voltage applied to said STN liquid crystal cell may be adjusted to provide a desired reflectivity of light by the mirror in accordance with the detected intensity of light.

21. The variable reflectance vehicle mirror of claim 1, wherein said mirror is formed to include a rimless outer periphery.

22. The variable reflectance vehicle mirror of claim 1, wherein rimless outer periphery of said mirror is accomplished by trimming the stacked configuration of the STN liquid crystal cell, first and second polarization filters, and reflective layer after the stacked configuration is formed.

23. The variable reflectance vehicle mirror of claim 1, wherein the stacked configuration of the STN liquid crystal cell, first and second polarization filters, and reflective layer are trimmed using a water jet to fuse the edges of these layers in the stacked configuration together.

24. The variable reflectance vehicle mirror of claim 1, wherein the mirror can be controlled to adjust the level of reflectivity to a value between approximately 28% and approximately 94%.

25. The variable reflectance vehicle mirror of claim 1, further comprising a first photo sensor for detecting an intensity of a glare-causing light impinging upon said photo sensor and providing a signal indicative of the intensity of the light detected, said control circuit being connected to said first photo sensor for receiving the signal indicative of the intensity of the light detected and applying a bias voltage to said STN liquid crystal cell accordingly to control the degree of reflectivity of the mirror.

26. The variable reflectance vehicle mirror of claim 25, further comprising a second photo sensor for detecting ambient light levels and providing a signal indicating when the intensity of the ambient light detected is greater than a threshold value, said control circuit being connected to said second photo sensor for receiving the signal indicative of the intensity of the ambient light detected being greater than the threshold value so that said control circuit disables the effect of the first photo sensor in controlling the degree of reflectivity of the mirror when the ambient light detected being greater than the threshold value.

27. The variable reflectance vehicle mirror of claim 26, wherein said first and second photo sensors are directly attached to a housing for the mirror.

28. The variable reflectance vehicle mirror of claim 1, wherein said mirror is an independently controlled interior rearview mirror for a vehicle.

29. The variable reflectance vehicle mirror of claim 1, wherein said mirror is an independently controlled exterior mirror for a vehicle.

30. The variable reflectance vehicle mirror of claim 1, further comprising:
an anterior transparent panel adjacent to said first polarization filter; and

a posterior transparent panel adjacent to said reflective layer adjacent to said second polarization filter.

31. The variable reflectance vehicle mirror of claim 30, wherein said anterior transparent panel and said posterior transparent panel are comprised of glass.

32. The variable reflectance vehicle mirror of claim 30, wherein said anterior transparent panel and said posterior transparent panel are comprised of synthetic plastic.

33. The variable reflectance vehicle mirror of claim 30, wherein said anterior transparent panel includes at least one optically enhancing coating.

34. The variable reflectance vehicle mirror of claim 30, wherein said anterior transparent panel includes an abrasion resistant coating formed thereon.

35. The variable reflectance vehicle mirror of claim 34, wherein said abrasion resistant coating comprises an organo-silicone (methylpolysiloxane) polymer with a thickness of approximately 2 to 10 microns.

36. The variable reflectance vehicle mirror of claim 30, wherein said anterior transparent panel includes a hydrophilic coating formed thereon comprising zirconia and silicone dioxide.

37. The variable reflectance vehicle mirror of claim 30, wherein at least one of said anterior and posterior transparent panels includes a hydrophobic coating containing a concentration of oxides and a concentration of perfluoroalkylsilane.

38. A variable reflectance vehicle mirror which can be controlled to adjust reflectivity, wherein the variable reflectance is provided by a super twisted nematic (STN) liquid crystal cell having variably controllable transmittance.

39. The variable reflectance vehicle mirror of claim 38, wherein the birefringence of the STN liquid crystal cell is controlled to adjust the reflectivity of the mirror.

40. The variable reflectance vehicle mirror of claim 38, wherein the reflectance is continuously variable.

41. The variable reflectance vehicle mirror of claim 38, further comprising a control circuit connected to said STN liquid crystal cell for controlling the birefringence of the STN liquid crystal cell to adjust the reflectivity of the mirror.

42. The variable reflectance vehicle mirror of claim 38, further comprising:
a first polarization filter positioned on a front side of said STN liquid crystal cell;
a second polarization filter positioned on a rear side of said STN liquid crystal cell; and
a reflective layer positioned adjacent to said second polarization filter.

43. The variable reflectance vehicle mirror of claim 42, wherein said reflective layer comprises an enhanced aluminum material.

44. A variable reflectance vehicle mirror which can be controlled to adjust reflectivity, comprising:
a super twisted nematic (STN) liquid crystal cell having a front side and a rear side;
a first polarization filter positioned on the front side of said STN liquid crystal cell;
a second polarization filter positioned on the rear side of said STN liquid crystal cell; and
a reflective layer positioned adjacent to said second polarization filter;
wherein the variable reflectance vehicle mirror is formed to have a rimless outer periphery.

45. The variable reflectance vehicle mirror of claim 44, wherein the rimless outer periphery of said mirror is achieved by trimming the stacked configuration of the STN liquid crystal cell, first and second polarization filters, and reflective layer after the stacked configuration is formed.

46. The variable reflectance vehicle mirror of claim 45, wherein the outer periphery of said mirror is trimmed by a water jet procedure which fuses an outer periphery of the various layers of said mirror together to provide a weather-resistant seal around the outer periphery of said mirror.

47. A control device for controlling the reflectivity of a variable reflectance vehicle mirror which utilizes a super twisted nematic (STN) liquid crystal cell to control reflectivity, comprising:

a light detector for detecting an intensity of light impinging upon the variable reflectance mirror; and

a control circuit responsive to the detected light intensity which is connected to the STN liquid crystal cell for controlling the birefringence of the STN liquid crystal cell to adjust reflectivity of the mirror.

48. The control device of claim 47, wherein said control circuit controls the birefringence of the STN liquid crystal cell by controlling a bias voltage applied across the STN liquid crystal cell.

49. The control device of claim 48, wherein the bias voltage applied across the STN liquid crystal cell may be varied to vary a twist angle of molecules of a STN liquid crystal material contained within the STN liquid crystal cell to alter the reflectivity of the mirror to a desired level.

50. The control device of claim 49, wherein said STN liquid crystal material possesses a twist angle between approximately 180° and approximately 270° in the STN liquid crystal cell.

51. The control device of claim 50, wherein said STN liquid crystal material possesses a twist angle of approximately 210°.

52. The control device of claim 47, wherein said control circuit may control the reflectance of the variable reflectance mirror over a continuous range by varying the bias voltage applied across the STN liquid crystal cell.

53. The control device of claim 47, further comprising a voltage regulator capable of receiving a source of power from a vehicle from between approximately 6 - 40 volts d.c. and generating a bias voltage to be applied to said STN liquid crystal cell between approximately 2.7 to 5.5. volts d.c.

54. The control device of claim 53, wherein said voltage regulator enables the mirror to be retrofit into all existing vehicles by utilizes an existing power harness in the vehicle which provides approximately 6 - 40 volts d.c.

55. The control device of claim 47, wherein said control circuit is formed as a stacked IC.

56. The control device of claim 47, wherein said control circuit includes an oscillator formed within the stacked IC for variably adjusting a driving frequency applied to the STN liquid crystal cell.

57. The control device of claim 47, wherein the bias voltage applied to said STN liquid crystal cell may be adjusted to provide a desired reflectivity of light by the mirror in accordance with the detected intensity of light.